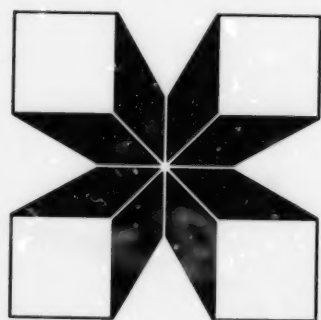


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C A N A D A

**RESEARCH RESOURCES IN
NATIONAL RESEARCH
INSTITUTIONS IN EASTERN
AND SOUTHERN AFRICA**

Z.M. NYIIRA

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Le Centre de recherches pour le développement international, société publique créée en 1970 par une loi du Parlement canadien, a pour mission d'appuyer des recherches visant à adapter la science et la technologie aux besoins des pays en développement; il concentre son activité dans six secteurs : agriculture, alimentation et nutrition; information; santé; sciences sociales; sciences de la terre et du génie et communications. Le CRDI est financé entièrement par le Parlement canadien, mais c'est un Conseil des gouverneurs international qui en détermine l'orientation et les politiques. Établi à Ottawa (Canada), il a des bureaux régionaux en Afrique, en Asie, en Amérique latine et au Moyen-Orient.

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This series includes meeting documents, internal reports, and preliminary technical documents that may later form the basis of a formal publication. A Manuscript Report is given a small distribution to a highly specialized audience.

La présente série est réservée aux documents issus de colloques, aux rapports internes et aux documents techniques susceptibles d'être publiés plus tard dans une série de publications plus soignées. D'un tirage restreint, le rapport manuscrit est destiné à un public très spécialisé.

Esta serie incluye ponencias de reuniones, informes internos y documentos técnicos que pueden posteriormente conformar la base de una publicación formal. El informe recibe distribución limitada entre una audiencia altamente especializada.

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April 1991

**Research resources in
national research institutions
in Eastern and Southern Africa**

Z.M. Nyiira

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TABLE OF CONTENTS

	Page
FOREWORD	v
LIST OF ACRONYMS	vii
EXECUTIVE SUMMARY	ix
I. THE SURVEY	1
Background	1
Objectives and Scope	1
Selection of Institutions	2
Consultants	2
Standardisation of Survey Methodology	2
Profile of National Institutions Surveyed	3
II. FINDINGS AND OBSERVATIONS	9
Human Resources	9
Financial Resources	18
Institutional Linkages	24
Clients for and Users of Research Output	27
Factors Facilitating or Limiting Research	29
III. CONCLUSION	32
Depth and Quality of Information	32
Recommendations	33

Table of Contents (Cont'd)

	Page
Annex I Trend in Total Number for Scientists	35
Annex II Scientific Staff Qualification Index	36
Annex III Number of Scientists with at least a Second Degree	37
Annex IV Majority of Scientists are Nationals	38
Annex V Scientific Staff by Research Sector	39
Annex VI Source of Research Funding for Selected National Research Institutions in Eastern and Southern Africa	40
Annex VII Budget Allocation on Personnel Emoluments and Research Expenditure for Selected National Research Institutions in Eastern and Southern Africa	41
Annex VIII Consultants' Biosketches	42
Annex XI Acknowledgements	45

FOREWORD

About two years ago at the request of the IDRC Board of Governors, the Office of Planning and Evaluation (OPE) coordinated a Centre -wide policy study on sub-Saharan Africa (SSA). The exercise included a critical review of quantitative and qualitative data on the actual and potential human and financial resources available to national and regional research institutions and centres. Although there was ample data on research resources in the agricultural sector, information on other research areas was either anecdotal or unreliable. To overcome this dearth of information, OPE commissioned surveys of national research resources in five countries in Eastern and Southern Africa, namely Kenya, Malawi, Mozambique, Tanzania, and Zimbabwe. This **synthesis report** is based on these individual studies. Because only five out of the 13 countries in the region were covered and considering that it took a mere two months to prepare each national study, it cannot be said that the present report provides a complete picture of the research resources situation in the region. However, there is enough useful information to build on in the future.

The Office of Planning and Evaluation is particularly grateful to Dr. Nyiira for diligently synthesising a myriad of data into this manuscript report, which we hope the research and scientific community in the region as well as in the other parts of SSA, will find useful. I would also like to thank Susan Wilkinson for aggregating the various statistical data into readable tables and graphs.

W. Douglas Daniels
Director
Office of Planning and Evaluation



LIST OF ACRONYMS

ACIAR	Australian Council for International Agricultural Research
AIA	Appropriations-in-Aid
APARC	Archives for Cultural Heritage (Mozambique)
BARS	Bvumbwe Agricultural Research Station
CARS	Chitedze Agricultural Research Station
CASS	Centre for Applied Social Studies (Zimbabwe)
CFF	Centre for Forest Research (Mozambique)
CIBC	Commonwealth Institute of Biological Control
CRF	Coffee Research Foundation
EEC	European Economic Community
EMU	Eduardo Mondlane University
FAO	Food and Agriculture Organisation
FAMESA	Financial and Administrative Management of Research Projects in Eastern and Southern Africa
FRC	Forestry Research Centre
FRIM	Forest Research Institute of Malawi
GDP	Gross Domestic Product
GRD	German Democratic Republic
GSD	Geological Survey Department
GTZ	German Agency for Technical Cooperation
ICI	Imperial Chemical Industries
ICIPE	International Centre of Insect Physiology and Ecology
ICRISAT	International Centre for Research in Semi-Arid Tropics
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
IIP	Institute of Fisheries Research (Mozambique)
IITA	International Institute of Tropical Agriculture
IMR	Institute of Mining Research
INIA	Institute of Agricultural Research (Mozambique)
INIVE	National Institute of Veterinary Research (Mozambique)
INS	National Institute of Health (Mozambique)
ISNAR	International Service for National Agricultural Research
JICA	Japanese International Cooperation Agency
KARI	Kenya Agricultural Research Institute
KEMFRI	Kenya Marine Fisheries Research Institute
KEFRI	Kenya Forestry Research Institute
KEMRI	Kenya Medical Research Institute
KETRI	Kenya Trypanosomiasis Research Institute
KIRDI	Kenya Industrial Research and Development Research Institute
MARS	Makoka Agricultural Research Station
MBS	Malawi Bureau of Standards
MRS	Matopos Research Station
NIMR	National Institute for Medical Research
NCST	National Council for Science and Technology
NGO	Non-Governmental Organisation

List of Acronyms (Cont'd)

NORAD	Norwegian Agency for Development
NRC	National Research Council
NRZ	National Railway of Zimbabwe
ODNRI	Overseas Development Natural Resources Institute
R&D	Research and Development
SADCC	Southern African Development Coordinating Conference
SAREC	Swedish Agency for Development Cooperation
TARO	Tanzania Agricultural Research Organisation
TAFIRI	Tanzania Fisheries Research Institute
TAFORI	Tanzania Forestry Research Institute
TRB	Tobacco Research Board
TPRI	Tropical Pesticide Research Institute
TIRDO	Tanzania Industrial Research and Development Organisation
TRF	Tea Research Foundation
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USSR	Union of Soviet Socialist Republic
UTAFITI	Tanzania Commission for Science and Technology
WHO	World Health Organisation
ZIDS	Zimbabwe Institute of Development Studies
ZSA	Zimbabwe Sugar Association

EXECUTIVE SUMMARY

1. Resource investment and management are critical considerations in research and development (R&D). The impact on science and technology research and development and overall national development of human, financial, information and material resources, and their influence on the structure and performance of national research institutions, is a subject of critical review among donors and international development agencies.

2. This synthesis of research resources in national research institutions was undertaken to collate, aggregate and determine the extent and quality of information on resources available to national research institutions in selected countries of eastern and southern Africa.

3. The surveys revealed, that the human resource capacity in national research institutions in the region has significantly improved during the last 15 years (Annex I). Trained scientific manpower has steadily grown. The majority of the institutions surveyed boast between 40-50% of their scientific staff with at least a second degree (Annexes II-III). Future training need seems to be in the non-traditional and emerging areas of specialisation. The staff position, though not adequate, has significantly improved during the last 10 years. Staff mobility and turnover has been dropping gradually.

4. The majority of the research scientists are nationals with a steady drop in the number of expatriates (Annex IV). Their distribution closely follows the objectives of their institutions and programmes (Annex V).

5. There is still a conceivable need for strengthening manpower in national research institutions preferably through Ph.D. training and management development. This effort should be matched by technical staff training to upgrade their capacity and technology application skills.

6. The level of research funding has constantly improved in all the institutions surveyed (Annex VI), but overall national funding is still much below the level of 0.5% of GDP. As much as there exists variation from country to country, institution to institution, and year to year, in the majority of cases, there is a marked expansion in the financial resources allocated for both recurrent and capital expenditure.

7. The disturbing feature is that between 80-90% of the total recurrent budget in the majority of the institutions is spent on personnel emoluments. Allocation of funds for actual research execution remains unsatisfactory (Annex VII).

Executive Summary (Cont'd)

8. Scientists are usually not involved in the planning and preparation of budgets as this responsibility is considered to be for finance and accounting departments. Accounting procedures, internal control and reporting systems are poorly understood, and the overall institutional financial management is poor in the majority of the institutions surveyed. It is essential, if institutions building efforts are to be successful, that financial management should be considered a priority area of education and training.

9. Formal institutional linkages both at the policy and operational levels, among institutions and between research institutions and users of research outputs, are still weak or non-existent. There appears to exist stronger linkages between national and non-national institutions and agencies mainly due to technical assistance and external funding. There is an apparent lack of awareness and information to facilitate inter-institutional linkages. National research systems should be assisted in developing awareness of potential linkages and collaborative opportunities, perhaps, through an information support system.

10. Except for client-oriented research institutions, the major direct client of research output for almost all the institutions surveyed is the government through extension services and other agencies.

11. There is evidence from all countries surveyed that there is political will and commitment to promote science and technology. This development relates to the kind of policies that are in place and ones which should be evolved to support national research efforts. Policy development and policy management are, therefore, critical considerations in the performance of research institutions. It is suggested that these issues be given prominence in IDRC's institution building efforts.

I. THE SURVEY

BACKGROUND:

In recent years, support by donors and international development institutions for research and development activities in sub-Saharan Africa has increased. Consequently, interest in the status of resource investment in research has been growing. The question of whether national research systems in the region are investing sufficient resources into research, which in turn impact on the productivity of the research sector, is constantly raised and appears worthy of specific consideration.

Attempts have been made since 1981 to examine the level and trend of resources allocated to research in national institutions, and the consequence of imbalances and limitations of resources on the capability of research to meet national expectations; and to evaluate the impact of institutional structures on resource performance, distribution, stability and social goals. Rather than achieve their objectives, such attempts have often ended up examining resource allocation policies.

OBJECTIVES AND SCOPE:

The purpose of this project was to collate information on research resources in national research institutions.

The specific objectives of the project were:

- a) to determine the extent and quality of information on the resources available to national research institutions in selected countries in Eastern and Southern Africa;
- b) to collect and aggregate information available from representative national research coordinating agencies and other sources on the research resources available in the selected countries.

The initial focus of the study was on the collection of quantitative information on individual institutions aggregated on a country basis. From deliberations of the pre-implementation workshop, it was decided that qualitative information pertinent to the research environment of the institutions covered by the study would be included.

SELECTION OF INSTITUTIONS:

The countries selected for the survey represent a cross section of the regional environment namely the Southern African Development Coordination Conference (SADCC) and non-SADCC countries, Eastern and Southern sub-regions and English as well as Portuguese speaking countries. In each country, both agricultural and non-agricultural institutions were considered.

FAMESA has a very elaborate network of multisectoral institutions. They include agricultural, medical, industrial and energy-related research institutions, management training institutions, national councils of technology and institutes of development studies. The selection of FAMESA as the focus for undertaking this survey, considered this factor in addition to FAMESA's 1984 experience with a similar exercise conducting a survey in Eastern and Southern Africa to establish the strengths and weaknesses of national research institutions in the region.

CONSULTANTS:

The consultants chosen have been associated with FAMESA and with efforts in their countries and the region for strengthening national research systems. Their selection introduced into the study multisectoral experience founded on individual backgrounds and the institutions of employment. There are two consultants each from the agricultural and medical research institutions; one from the council of science and technology; one each from the university, management training institute and institute of development studies. This balance introduced a varied but rich perspectives into the survey methodology. Furthermore, consideration was given to the experience and senior positions held by the consultants in their own national research systems as indicated in their biosketches (Annex VIII).

STANDARDISATION OF SURVEY METHODOLOGY:

A pre-implementation workshop was organised on May 15th 1989 to discuss survey procedures and methodology standardisation. The project consultants from Kenya, Malawi, Mozambique and Uganda, as well as the principal coordinator of the project and an IDRC representative, were in attendance.

The specific objectives of the workshop were to:

- a) reach consensus on the detailed information to be collected;
- b) create the appropriate data collection instruments;

- c) agree on a common method for analyzing and presenting statistical data;
- d) agree on the size and key characteristics of the sample; and
- e) agree on a common workplan for implementing the survey.

Wide-ranging methodological issues were discussed including a comprehensive review of the objectives and scope of the project, selection criteria for institutions to be selected for the study, institutional resource needs, details and depth of information required, its organisation, and processing and presentation. By the end of the workshop, appropriate sources of information on priority resource needs of national research institutions had been identified and agreement reached on standard methodology enabling aggregation and comparison of the final data.

PROFILE OF NATIONAL INSTITUTIONS SURVEYED:

Kenya:

The history of Kenya's national research institutions dates back to the beginning of this century. These national institutions were complemented by several regional research organisations established by the East African Community and its predecessor, the East African High Commission. Between 1979 and early 1987, the National Science and Technology Council (NSTC) was responsible for the country's research policy. Since then, the Ministry of Research, Science and Technology has been responsible for designing research policy and coordinating all research and technology development activities.

Mission-oriented research is undertaken in six institutions established under the Science and Technology Act of 1979. These cover agriculture, industry, fisheries, health and environment and natural resources.

Some specialised research is, however, still undertaken in individual ministries. Apart from these, there are two client-centred public funded research institutions for the coffee and tea industries. Kenya also houses a number of international and regional research institutions which have firm linkages with national research institutions. A number of non-governmental organizations are also engaged in mostly applied and operational research.

Based on the history and structure of the research institutions and their mandates, the following were selected for inclusion in the survey of research resources in Kenya's national institutions:

CATEGORY	SECTOR	INSTITUTION
Mission-oriented	Agriculture	Kenya Agricultural Research Institute (KARI)
Client-centred	Coffee	Coffee Research Foundation (CRF)
Client-Centred	Tea	Tea Research Foundation (TRF)
Mission-oriented	Health	Kenya Medical Research Institute (Kemri)
		Kenya Trypanosomiasis Research Institute (KETRI)
Mission-oriented	Industry	Kenya Industrial Research & Development Institute (KIRDI)
Mission-oriented	Fisheries	Kenya Marine Fisheries Research Institute (KEMFRI)
Mission-oriented	Nat. Resources	Kenya Forestry Research Institute (KEFRI)

Malawi:

The country's research policy is coordinated by two separate institutions. The Agricultural Research Council, created in 1982 to provide direction and leadership in agricultural research, is custodian of the agricultural research policy. Policy for other research is coordinated by the National Research Council, established in 1974 to advise government on scientific research and technology policy. The National Research Council is in the Office of the President and is the focal point for foreign research funding agencies.

On the basis of their mandates and sector representation the following institutions were selected for examination:

CATEGORY	SECTOR	INSTITUTION
Mission-oriented	Agriculture	Chitedze Agricultural Research Station (CARS)
		Makoka Agricultural Research Station (MARS)
		Bvumbwe Agricultural Research Station (BARS)
Mission-oriented	Forestry	Forest Research Institute of Malawi (FRIM)
Client-oriented	Geology	Geological Survey Department (GSD)
Client-oriented	Quality Control	Malawi Bureau of Research Standards (MBS)

Mozambique:

Eduardo Mondlane University (EMU) is the focal institution for the research processes, although research policy is defined by and is a responsibility of sectoral ministries and Secretaries of State under which specific research institutions are organised. There are 13 national scientific research institutions with mandates for research, extension, teaching and curriculum development. The research carried out by these institutions is funded from the national budget and through collaborative linkages with international and regional organisations.

For the present survey six institutions were selected on the basis of the relevance of their mandates and research programmes. They are:

CATEGORY	SECTOR	INSTITUTION
Mission-oriented	Agriculture	Institute of Agricultural Research (INIA)
		National Institute of Veterinary Research (INIVE)
		Centre for Forestry Research (CEF)
Mission-oriented	Fisheries	Institute of Fisheries Research (IIP)
Mission-oriented	Health	National Institute of Health (INS)
Mission-oriented	Culture	Archives of Cultural Heritage (ARPAC)

Tanzania:

The Tanzania Commission of Science and Technology (UTAFITI) is responsible for the country's overall science and technology policy. The national science and technology institutional structure currently comprises 17 institutions with sufficient autonomy to undertake research and development in a variety of areas. The University of Dar es Salaam and Sokoine Agricultural University complement the efforts of bona fide research institutions by undertaking mission-oriented and basic research and developing scientific and technical manpower for meeting the country's needs.

For the aims of this project, five institutions were selected. Four institutions represent natural resources, industry and medical and health sectors. The fifth, the Tanzania Tropical Pesticides Research Institute (TPRI), was included in the survey because of the multidisciplinary nature of its research activities. The institutions selected are:

CATEGORY	SECTOR	INSTITUTION
Mission-oriented	Medical	National Institute for Medical Research (NIMR)
Mission-oriented	Industry	Tanzania Industrial Research and Development Organization (TIRDO)
Mission-oriented	Multidisciplinary Research	Tanzania Tropical Pesticide Research Institute (TPRI)
Mission-oriented	Natural Resources	Tanzania Forestry Research Institute (TAFORI)
		Tanzania Fisheries Research Institute (TAFIRI)

Zimbabwe:

Research in Zimbabwe is of three categories: client-oriented, mission-oriented and scientific-instituted. The present study covered institutions engaged in all of them namely:

CATEGORY	SECTOR	INSTITUTION
Client-oriented	Agriculture	Tobacco Research Board (TRB)
		Zimbabwe Sugar Association (ZSA)
Mission-oriented		Matopos Research Station (MRS)
Client-oriented	Industry	National Railway of Zimbabwe (NRZ)
Mission-oriented	Natural Resources	Forestry Research Centre (FRC)
		Institute of Mining Research (IMR)
Scientist-Instituted/Mission oriented	Social Science	Centre for Applied Social Sciences (CASS)

The discussion, particularly of institutional linkages and policy implications covered a broader range of institutions than those examined in detail for the financial and human resource survey.

II. FINDINGS AND OBSERVATIONS

HUMAN RESOURCES:

The Scientific and technical potential of national research systems can be fully exploited only if a country has sufficient quantity and quality, the essential and well equipped human resources. The ability of a country to seek, test, adapt and utilise information from other sources is also determined by this factor. The Eastern and Southern African countries took cognizance of the United Nations revelation in its "World Plan of Action for the Application of Science and Technology to Development" where it was observed that:

"A country without an indigenous scientific and technological capacity has no means of being aware of its own needs, nor of the opportunities existing in science and technology elsewhere, nor the suitability of what is available for its own needs".

This observation revamped original efforts in the region to move more towards attaining a critical mass in manpower for research and development in national research systems.

The following summarises human resource situation in the countries surveyed.

Kenya:

Kenya's professional scientific staff in the eight institutes surveyed is close to 1000. It is supported by about 2000 technical staff and slightly over 8000 non-technical, administrative and support staff. The Kenya Agricultural Research Institute (KARI) has the highest number of scientific staff i.e. 600 scientists accounting for 59% of the country's total scientific staff, followed by Kenya Medical Research Institute (KEMRI) with 125 scientists. Tea Research Foundation has the lowest number with only 15 scientists.

Client-oriented research institutes namely, Coffee Research Foundation and the Tea Research Foundation have better technical staff support with a ratio of 5-7 technical staff per scientist compared to the mission-oriented institutions where each scientist is supported by two technicians.

The majority of research scientists are nationals. Out of 600 scientists at the Kenya Agricultural Research Institute, only 17 are non-nationals; three of them from sub-Saharan Africa and the rest from outside Africa. There are 25 non-national scientific staff at the Kenya Medical Research Institute out of a total 125 professional staff; three are from sub-saharan Africa and 22 from outside Africa. The number of expatriates at the Kenya Forestry Research Institute (KEFRI) is 12 from outside Africa out of a total of 61 scientific staff.

It would appear that the non-nationals working within national research institutes are technical cooperation officers on donor funded or other collaborative projects.

By sector, agriculture employs the greatest number of scientists. Their number rose from about 330 in 1979 to 500 in 1984 and 600 in 1989. The medical and health-related sector grew from a scientific staff strength of 28 in 1979 to 137 in 1984 and 184 in 1989.

The expansion in scientific staff in the natural resources sector is dramatic. There were 6 scientists in 1979, 36 in 1984 and 61 in 1989.

The expansion in the number of professionals was reciprocated by an expansion in technical and administrative staff in all the sectors.

It is evident that agricultural research is accorded the highest priority, but a significant effort has been made to strengthen the Health and Natural Resources as well as Industrial research sectors.

There is a general shortage of trained manpower particularly at the Ph.D. degree level. Out of a total 920 scientists, only 5.5% have Ph.D. degrees, 42% have M.Sc. degrees and the rest (52.4%) hold first degrees. On the basis of these figures, it seems necessary to encourage a scheme transforming more of the first degree holders into M.Sc. degrees holders which is the acceptable qualification for research scientists.

Staff mobility and turnover within national research institutions in Kenya has not been a major problem. Where this problem has been experienced, it has been attributed to better prospects in fringe benefits in alternative institutions. There is evidence that there was higher turnover of staff in institutions with close interaction between staff and industry with the resultant movement of staff to the industries.

Malawi:

Survey responses indicated that the majority of scientific staff are Malawian nationals. The current number of staff per institute ranged from 8 at Makoka

Agricultural Research Station to 62 at Chitedze Agricultural Research Station. This latter station had the highest number of scientific staff followed by the Geological Survey Department and Bvumbwe Agricultural Research Station with 22 scientists each. All the institutions experienced an increase in scientific staff accompanied by similar expansion in technical and non-technical staff, except the Forest Research Institute of Malawi and Makoka Agricultural Research Station, where there was negative staff expansion.

A 15% overall professional staff loss factor was recorded for all the institutes surveyed. This is accounted for by staff movements, promotions, transfers and resignations.

At the Forest Research Institute of Malawi, the number of scientific staff fell from 13 in 1979 to 10 in 1989. During the same period, however, the nationals assumed a greater role; rising from 39% in 1979 to 91% in 1989. Chitedze Agricultural Research Station currently has 62 researchers; 92% are nationals. The percentage of non-nationals increased from 2% in 1984 to 8% in 1989. The population of Malawian scientists at the station grew from 19 in 1979 to 43 in 1984. This increase is attributed to project staff and technical assistance. The majority of the scientists (16%) are engaged in agronomic studies. Plant Breeding and Economics occupy 8% and 13%, respectively, of the scientific staff while Animal Science has 10%.

The survey revealed that Malawi Bureau of Standards has 10 scientists, all nationals, engaged mainly in product testing to verify product characteristics in collaboration with quality control scientists and technologists. There has been fluctuations due to secondments and desecondments of both scientific and technical staff since 1974 when the institution had only three professional staff; but overall, there has been an increase in both categories.

In the case of Makoka Agricultural Research Station, the number of scientific staff declined from 11 in 1984 to the present seven but the percentage of nationals grew from 36% to 100%.

At Bvumbwe Agricultural Research Station, the number of scientific staff doubled from 10 in 1974 to 21 and 22 in 1984 and 1989, respectively. The percentage of expatriate staff increase from 87% in 1979 to 95% in 1984 and beyond. The higher number of expatriates is due to the magnitude of technical assistance and non-Malawian project staff based at the station.

The Geological Survey Department has 22 scientists, the majority (95%) are Malawians. 46% of the total scientific staff are engaged in mineral exploration. The

rest are divided into geological mapping (5 scientists), industrial mineral and ceramics (5 scientists) and energy minerals (2 scientists).

The survey recorded that 57 out of the total 114 scientific staff in Malawi hold at least an M.Sc. Only 12% of the total number of scientists possess Ph.D. degrees. The Forest Research Institute has 5 researchers with M.Sc.; the rest are holders of first degrees. Out of a total of 62 researchers at Chitedze Agricultural Research Station, 27 and 8 scientists have M.Sc. and Ph.D. degrees, respectively. At the Malawi Bureau of Standards, the majority (7 out of 10) have B.Sc. degrees with only 2 Ph.D. degree holders and 1 M.Sc. degree holder.

82% of the researchers at the Geological Survey Department have B.Sc. degrees. None has a Ph.D. degree.

At Makoka Agricultural Research Station all scientists except one have at least a second degree (4 M.Sc. and 3 Ph.D.). Bvumbwe Agricultural Research Station has 13 B.Sc. degree holders, 7 M.Sc. and 1 Ph.D.

Generally, the institutions surveyed reflect a good level of effort on training research scientists to an acceptable qualification for research work. 50% of the total scientific staff have at least a second degree.

It was observed that the average time spent per scientist per week at the Forest Research Institute of Malawi is divided as follows: 30 hours on research activities, 6.5 hours on administrative duties and 6 hours on advisory work. In the case of Chitedze Agricultural Research Station, an average of 2.5 hours per week is spent on teaching at institutions of learning, 10 hours on administrative activities and 30 hours on actual research work. Responses from Geological Survey Department indicated that of the 42.5 hours per week, the researchers spend 25 hours on research and 17.5 hours on management and administrative activities. In the case of Makoka Agricultural Research Station, the indication was, that the average time spent per week on research was 29 hours. Administrative activities occupied 10 hours, while 2 hours were on in-service training and 1.5 hours on report writing. For Bvumbwe Agricultural Research Station, the indication was 30 hours on research, 10 hours on administrative and advisory services and 2.5 hours on report and technical paper writing.

There was consistency in the amount of time spent on the various activities reported by the various institutes surveyed.

Mozambique:

Generally, the trend regarding human resources has improved dramatically since 1975. There has been sustained improvement in scientific staff in all the research institutions assessed in this survey there is also a steady increase in technical and non-technical staff. Compared to the overall country situation, however, there seems to exist a scarcity of human resources and a paucity of trained manpower both in the graduate and technical staff categories.

The number of scientific staff at the National Institute for Agricultural Research (INIA) has steadily increased from 13 in 1975 to 34 in 1989. Currently, only 35% of the scientific staff are Mozambican nationals. 64.7% are non-nationals from sub-Saharan Africa and other parts of the world. The Institute's main activity, Agronomy, engages 61.7% of the total scientific staff while Land and Water research employs the rest.

The National Institute of Veterinary Research (INIVE) had no scientific staff in 1984. Currently it has 15 research scientists supported by 88 technical and 23 non-technical staff. Out of the total 15 scientists, 10 are Mozambicans; five are non-nationals. The majority of the scientists (11 out of 15) are focusing on diagnostic research. The rest are working on biological production and quality control.

The Centre for Forest Research has a staff of only four people; three are nationals. The scientific staff distribution is 3:1 between Silviculture and Technology study areas.

The survey response from the Institute of Fisheries Research (IIP) indicated a current scientific staff strength of 16 people supported by 42 technical staff and 17 non-technical support staff. Of the 16 researchers, only 10 are nationals. 69% of the scientific staff are doing research on fish biology with only three researchers in aquaculture and two scientists in oceanography. There are no scientists on fish technology and quality control research.

The National Institute of Health (INS) has had a strong scientific staff position. The number rose from 24 researchers in 1984 to a current level of 29, 10 of whom are Mozambicans and the remaining 19 are non-nationals of unspecified category. Research on malaria involves 35% of the researchers. The rest are distributed to research on epidemiology (4), parasitology (2), immunology (5), microbiology (3), traditional medicine (4) and trypanosomiasis (1).

There are nine scientists at the Archives of Cultural Heritage (ARPAC); eight are nationals. Six are engaged in anthropological research, two on linguistics and one on documentation.

The major problem revealed by the survey is the inadequacy of the present scientific staff and weak skilled manpower at the technical support level. This problem is attributed to the country's historical background particularly to the fact that the country, up to the attainment of political independence, had no national institutions of higher learning. It depended on expatriates and the few graduates trained outside.

Tanzania:

Most of the R&D institutions were established during the last 10-15 years and are, therefore, relatively new. However, much effort has been put into institutional organisation and manpower development to satisfy the requirements of scientific and technological capacity projected in the 1984 manpower survey report of Tanzania's Ministry of Manpower Development.

The majority of R&D institutes surveyed suffer from a lack of qualified personnel. By 1989, the Tanzania Agricultural Research Organization, which was reorganised during the year, had 159 research scientists compared to the Tropical Pesticide Research Institute (34), Tanzania Fisheries Research Institute (31), National Institute of Medical Research (28), Tanzania Forestry Research Institute and Tanzania Industrial Research and Development Organisation (25). The National Institute of Medical Research and Tropical Pesticide Research Institute had adequate technical support staff with a ratio of 5 technicians per researcher. The rest of the institutes surveyed had less than 2 technical support staff per scientist and in the case of the Tanzania Industrial Research and Development Organisation, there was a negative ratio of 1 technician and 2 scientists. This is, perhaps, due to the specialised nature of research at this institute and lack of technical training facilities in the fields in which it is engaged. With the exception of Tanzania Fisheries Research Institute where there was significant expansion of scientific staff from 9-31 (71%) between 1984 and 1989, all the other institutes experienced staff expansion ranging between 14-18% over the same period.

The National Institute of Medical Research increased its scientific staff during 1984-1989 from 23 to 28 (17.8%) marked by an expansion in technical support staff of 24% from 96 to 127 in the same period. The Tanzania Industrial Research and Development Organisation experienced a modest expansion of its scientific staff from 20 in 1979 to 25 in 1989; an increase of 20%. The

number of scientists at the Tropical Pesticide Research Institute grew by 14.7% between 1984 and 1989. During the same period, Tanzania Research Institute registered an increase in scientific staff of 16%.

All scientific staff in the institutions surveyed are nationals except for Tanzania Industrial Research and Development Organisation where there are 4 expatriates from outside sub-Saharan Africa. Similarly, all the technical support staff are Tanzanians.

of the 28 research scientists at the National Institute of Medical Research, 18 (79%) have M.Sc. and 4 (14.3%) have Ph.D. degrees. The rest have first degrees. The distribution of scientific staff by research areas emphasises malarial research at Amani involving 44% of the total 1989 scientific staff strength.

The Tanzania Industrial Research and Development Organisation has three Ph.D. and eight M.Sc. degree holders out of a total of 29 researchers. 62% of the scientists have the initial B.Sc./B.A. degrees. The current distribution of these scientists indicates that out of the 29 scientists 45% are engaged in chemistry and food research, 41% on plant breeding engineering, 10% on information and only one scientist on textile research. The absence of an economist on the institute's staff is rather unfortunate.

Currently, The Tropical Pesticide Research Institute has three Ph.D., 13 M.Sc. and 18 B.Sc. degree holders. This represents a 47% level of postgraduate training in the institute. Because of inter-institutional collaborative arrangements, it is difficult to establish the distribution of TPRI staff on specific projects. Their number by research area adds up to 158, whereas that cited earlier in this report is only 34 researchers. This disparity reflects the fact that some scientists from other institutes are based at TPRI as part of a collaborative arrangement with sister institutions. Alternatively, TPRI staff based at other centres e.g. Amani may not have been included in the staff figures. Notwithstanding the foregoing observation, it appears that emphasis by the institute is fairly well spread over all research areas. Of the 158 total scientific staff reported by sectors, 12% are doing research on Pesticide Registration and Control, 11% on mosquito entomology, 10% on tsetse entomology, and 8% each on acaricide research, Botany and Plant Pathology.

The Tanzania Forestry Research Institute has one Ph.D., 10 M.Sc and 14 B.Sc. degree holders, representing a 45.8% level of postgraduate training at the institute. Forest Breeding/Forest Biology and Forest Ecology currently have nine and eight scientists, respectively out of a total 24. Others are distributed in Forest Protection (3),

Wood Structure (2) and one each in Wood Preservation, Timber Engineering and Wood Energy.

At the Tanzania Fisheries Research Institute, out of 31 scientific staff strength, 15 (48.4%) have M.Sc. degrees and one has a Ph.D. degree. The survey did not reveal the distribution of manpower by research areas/sectors. However, from the list of current projects, it appears that Fish Biology and Fish Ecology are priority areas.

Survey responses revealed that the total time spent per week per researcher averages 40 hours. Out of this time, an average of 31 hours is spent on research (range 25-35 hours), 6 hours on other institutional duties and 3 hours on work outside the institution such as consultancies, patient care etc.

The number of hours spent on research per scientist at the National Institute of Medical Research averages 25 hours compared with 30 hours at the Tanzania Industrial Research and Development Institute, Tropical Pesticide Research Institute and Tanzania Fisheries Institute, and 35 hours at the Tanzania Forestry Research Institute. The time spent on non-research institutional activities was approximated at 14 hours for the National Institute of Medical Research, six hours for TIRDO, seven hours for TPRI, three hours for TAFORI and five hours for TAFIRI. It was estimated that scientists spend an average of 4 hours per week on consultations and non-institute activities at TIRDO, three hours at TPRI, two hours at TAFORI and five hours at TAFIRI.

Zimbabwe:

The number of scientific staff ranged from a total of two to 22 per institute. The national Railways of Zimbabwe (NRZ) had the lowest number of scientific staff (i.e. two people) and Tobacco Research Board had the highest number, with a total of 22 people in 1989. The scientific staff generally remained stagnant or increased slightly over time. Thus very few people are in the scientific category as compared to the technical and non-technical categories. The non-technical field had the highest number of people employed, with the Tobacco Research Board registering 210 employees and Centre for Applied Social Studies recording only two in 1989.

All research institutes surveyed currently have expatriates in their scientific staff except the Tobacco Research Board and National Railways of Zimbabwe. The Tobacco Research Board had one expatriate in 1974 and two in 1984 but by 1989, there was none. The International Centre for Research in Semi-Arid Tropics (ICRISAT) had 10 expatriates making it the largest holder of expatriate scientists among those surveyed. This is attributed to its status as an international organisation, which

recruits its staff across boundaries. In 1984, three expatriates, all from sub-Saharan Africa were employed; in 1989, seven additional expatriates coming from outside Africa were added. There are only two Zimbabweans on the scientific staff of ICRISAT.

The University of Zimbabwe's Centre for Applied Social Studies has three expatriates. All are from outside sub-Saharan Africa. The Institute of Mining Research of the University of Zimbabwe, has two expatriates; one from the sub-Saharan African region and the other from outside Africa. The remaining scientists are Zimbabweans.

Matopos Research Station is part of the Research and Specialist Services Department of the Ministry of Agriculture. It has two scientific staff both from outside Africa.

Survey responses indicate that the majority of expatriates employed in this area of research come from countries other than the sub-Saharan Africa region. In 1989, 20 expatriates were employed with 75% being non-nationals of the SSA region.

The average time spent per week per researcher was 40 hours. Each researcher spends about 30 hours on average doing scientific research. Thus 75% of a researcher's working time is spent on active research and the rest on non-research activities such as administration, meetings, discussions, teaching, consultancies, training and extension services.

Research in Zimbabwe suffers from a lack of skilled manpower. This staff shortage is due to the few trained scientific researchers in the country.

The survey recorded 85 scientific staff in the ten institutions, 34 had first degrees and the other half had either Masters or Ph.D. degrees, indicating a significant shortage of research calibre staff.

The two researchers at the National Railways of Zimbabwe are B.Sc. degree holders. This number is one less than their full complement, the missing expert being an environmental chemist. The difficulty to recruit this expert reflects a shortage of expertise and the failure of the parastatal to compete with levels of remuneration in the private sector.

In all areas of research, the scientific staff situation is worsened as many positions are filled by young Zimbabweans with qualifications but lacking in experience.

FINANCIAL RESOURCES:

Kenya:

The total R&D budget for Kenya has increased 10 fold between 1974 and 1988. Between 1979 and 1988 it expanded by a factor of 5 (i.e. 77.6%). During the last 4 years, the R&D budget has jumped from K f 17.2 million to K f 38.5 million; an increase of 55.3%. These figures represent an allocation of 0.44%, 0.43% and 0.54% of the Gross Domestic Product (GDP) in 1979, 1984 and 1988, respectively.

There exists great variation from year to year in the level of funding for individual institutes. The level of funding per institute as a per cent of GDP during the 1988/89 budget, ranges from 0.015% for Kenya Forestry Research Institute, to 0.17% for Kenya Agricultural Research Institute, compared to 1987/88 budget where the range was between 0.026% for Kenya Industrial Research and Development Institute, and 0.254% for Kenya Agricultural Research Institute. At the time of this survey, the estimated funding for the 1989/90 financial year of individual institutes was between 0.011% and 0.374% of the GDP.

Whereas, research funding of the institutes surveyed is around 1% of the national budget (1988/89), it is approximately 0.5% of the GDP. This level of funding is quite encouraging compared to most developing countries.

With regard to sources of research funding, government subvention contributed 70% of the total 1988/89 R&D institutional budget; 29% was from external sources, 1.8% from consultancies and services and 0.2% from miscellaneous sources. Of the K f 41.9 million total R&D budget for 1988/89, Kenya Agricultural Research Institute received K f 9 million from external sources, while Kenya Forestry Research Institute, Kenya Medical Research Institute and Kenya Trypanosomiasis Research Institute received K f 789,100, K f 475,750 and K f 50,000 respectively from the same source.

Of the total R&D budget for 1988/89, 9.3% (K f 3.9 million) came from private donations and fund raising. The Tea Research Foundation received K f 0.5 million out of this amount. The rest went to the Coffee Research Foundation. Consultancies and services contributed approximately K f 0.6 million each to Kenya Agricultural Research Institute and Coffee Research Foundation, while Tea Research Foundation's budget was increased by K f 123,980 from this funding source.

Appropriations-in-Aid (AID) accounted for 26.7% in 1988/89 and 29.8% in the previous financial year. This source of funding, however, has a bureaucratic complication. The funds accrued from a specific institute are paid to the Ministry of Finance and only returned through a reduction of the institution's budget by an equivalent amount as Appropriation-in-Aid.

Apart from the client-oriented research at the Coffee Research Foundation and the Tea Research Foundation which benefited from private sector funding, it appears from the survey that the private sector in Kenya has contributed very little to research funding. On the other hand, there was significant contribution to research funding by development research donors.

Of great interest, however, is the distribution of funds between personnel emoluments and operational funds in recurrent budgets of the various institutes. Except for the two-client-oriented research institutes namely Coffee Research Foundation and Tea Research Foundation where 42.6% and 40.9% of the recurrent budget respectively, were spent in 1988/89 financial year on personnel emoluments, all the other institutes had expenditures on personnel emoluments ranging from 61% to 91% of the total recurrent funds. Extreme cases were registered at the Kenya Marine Fisheries Research Institute, Kenya Forestry Research Institute and Kenya Industrial Research and Development Institute where 91.6%, 88.8% and 87.7%, respectively, of the total recurrent funding, were spent on personnel emoluments. A similar trend was recorded in the two previous years. This means, only 9-12% of the recurrent budget was available for research project activities; and therefore, the scientists were unable to conduct their research programmes effectively due to lack of material, supplies and services.

Malawi:

The survey indicated a systematic increase in the level of funding for research over the period from 1974 to 1989. The main source of research funding is the Government. There are, however, a number of external sources of funding mainly through donor agencies. In 1988/89, the budget for the Forest Research Institute of Malawi was MK 810,000. Of this amount, 25% was allocated to Capital Expenditure and 35% to research project activities. The rest was for staff salaries, overhead costs and other administrative support activities. It is interesting to note, that within the research projects, 34% of the funds was allocated to social forestry while allocation to each of the other activities did not exceed 14%.

Similarly, Chitedze Agricultural Research Station receives its funding from Government through the Ministry of Agriculture. Donor funded projects are funded through the Ministry of Finance. The annual budget for 1988/89 was MK 592,000. The expenditure on research project activities is not well reflected in the survey, but it is clear that general management and administrative support components including salaries and wages cost over 70% of the total budget. Considering the number of researchers at Chitedze, there does not seem to be sufficient funds for effective research except through donor funded projects.

The Malawi Bureau Standards is funded from three sources:

- (1) its own revenue from sale of documents and services;
- (2) government subventions; and
- (3) the National Research Council of Malawi.

The total annual expenditure for 1988/89 was MK 816,169 million. Of this, MK 18,432 million (2.3%) was capital expenditure and only MK 8,447 million (1.04%) spent on research project activities. 12.8% of the total annual expenditure went into salaries and wages.

Many of the research activities of the Malawi Bureau of Standards are related to development and quality control and funded mainly from the normal recurrent budget.

The budget for Geological Survey Department in 1988/89 was slightly over MK 4 million. Research project costs accounted for 15.6% of the total annual expenditure. Salaries and wages were allocated 30%. Overheads and general management and support services used 43.3% of the total budget. The survey revealed that the Geological Survey Department receives substantial donor support including funding from France and Japan.

Makoka Agricultural Research Station's total annual budget for 1988/89 amounted to MK 835,500 of which 20% was spent on research project activities; 4.7% on capital costs; 43.2% on salaries and wages, and 32.1% on utilities, general management and support services. The station's research work during the same period, was also supported by funding from Overseas Development Natural Resources Institute (ODNRI), International Institute of Tropical Agriculture (IITA), Commonwealth Institute of Biological Control (CIBC), International Development Research Centre (IDRC), GTZ and the private sector. Cotton and Cassava research received the highest amount of funding.

Bvumbwe Agricultural Research Station is funded by Government but has a number of projects funded through donor grants. It's annual budget during 1988/89 was MK 577,660. Approximately MK 330,000 (57%) was for research

project activity costs. Only 17.8% was spent on salaries and wages.

The general picture of the institutes surveyed is that the fraction of the total annual budget allocated to research activities is low. It ranges from 1% for Malawi Bureau of Standards to 35% for the Forest Research Institute of Malawi except for Bvumbwe Agricultural Research Station which, according to the survey results, allocated 57% of its 1988/89 total annual budget to research project activities.

Mozambique:

Research budgets and budget breakdown in Mozambique are not well organized. The cost of research carried out by national institutions is not well documented. Research institutions are part of Ministries and, as such, share part of the overall ministerial budget with centralised accounting systems. This state of management makes it difficult to extract specific expenditures for research and to estimate the actual research costs.

An important observation that came out of the survey is the contribution to research of external source of funding. The INIA budget for 1989 was US\$1.67 million. 87% of this was government subvention. CEF, during 1989, received 24% of its institutional budget from the government and 76% from external sources. IIP received external funding support to the tune of 81.5% of its total 1989 budget. During the same year, the government contributed only 28% to INS's annual R&D funding. Only APARC is wholly funded through government subvention.

The implication of this funding situation is that Mozambique currently relies heavily on external sources of funding for research; more specifically for training, technical assistance and for equipment, material and supplies. The survey revealed that the major donors are United Nations agencies and Nordic countries.

At the INIA, 70% of the institution's 1989 budget was allocated to salaries and wages and about 30% to overhead costs and general management and support activities. Research project costs appear to have been borne with the general management and support estimates. Of concern, however, there appears to have been no provision for capital development except in the previous year when only 2.9% of the total institutional budget was allocated to capital expenditure.

INIVE budget for 1989 was about 191 meticaïs out of which 69.9% was allocated to salaries and wages, 23% to capital expenditure and the rest to overhead costs and administrative activities. Once again, because of the

accounting procedure involved, the research project costs were accounted for in the recurrent expenditure.

CEF's total 1989 budget was estimated at 59 million meticaïs. Of this, 16% was for salaries and wages; 9% for capital costs and the rest for other expenditures including research project costs.

The picture is slightly clearer with the Institute of Fisheries Research. Salaries and wages accounted for 65% of the institution's 1989 budget. The research project activities were allocated 8%. Capital Expenditure accounted for 16.7% and the rest was allocated to overhead and general management and support costs. There was a significant increase (75%) in the amount allocated for research project activities from that vetted in 1988 compared to an expansion in the research project costs of only 20% between 1984 and 1988. The institute appears to have more donors than the rest among those surveyed. They include German Democratic Republic (GRD), NORAD, USSR, ODA and UNDP. Some of its work is also funded by the private sector (Sofala Bank) to evaluate coastal fish resources).

The level of expenditure on salaries and wages at the National Institute of Health is approximately 67% of the annual recurrent budget. It fell from 76% in 1988. The remaining portion accounts for capital expenditure and other recurrent costs.

The expenditure on personnel emoluments at the Archives of Cultural Heritage is as high as 88.8% of the total budget. Bearing in mind, that the remaining portion is meant to cover capital expenses, overhead and administrative costs, there is very little that can be allocated to actual research project activities.

Worthy of note concerning the overall financial resource situation in Mozambique is that the funds for research from external sources are disbursed in a similar mode as those obtained through government subvention. It is not clear from the survey, therefore, whether such funds are allocated to specific research activities or as general funds for a given sector.

Tanzania:

The major source of funding for R&D activities in Tanzania is the Government through subventions. The external source of funding has become more or less institutionalised mainly through special project funding, grants, collaborative research and technical assistance.

The total National Institute for Medical Research R&D recurrent budget increased from Tshs 13.9 million in 1984 to Tshs 61.7 million in 1989. Out of the recurrent

budget in 1989, 22.7% was allocated to research project activities, 60.6% to general management and support activities and 5.6% to overhead costs. Salaries and wages accounted for 33.8%. A provision of Tshs 12 million in 1984 and Tshs 14 million in 1989 was made for capital expenditure. The institute receives research grants from the World Health Organisation, UNICEF, IDRC, Rockefeller Foundation, JICA, Randolph-Geigy Foundation and the Tanzania Commission for Science and Technology.

The Tanzania Industrial Research and Development Organisation's budget in 1987 was about Tshs 38 million. From the budget breakdown it appears this figure included capital expenditure. The analysis of expenditures, revealing that only 8% of the total annual budget was spent on salaries and wages and 15% on administrative costs, casts doubt on the reliability of the original data. Examination of the current projects of the Institute, however, indicates that specific funds were allocated to over 10 projects through local and external funding sources.

The annual recurrent budget for the Tropical Pesticide Research Institute appears to tally with the staff strength of 34 scientists (rather than 158). However, the level of funding is so low (Tshs 16.9 million) that it is inconceivable how effective scientific research could be undertaken by the institute within this allocation. About 72.9% was for salaries and wages of the various staff categories; 9.1% was allocated to research project activities and the rest on overhead costs and general management and support services. The survey revealed that the institute has a potential of raising funds through consultancies and services. In 1984, some Tshs 990,000 was realised through this source. Otherwise, the institute is wholly supported by government subvention. The survey did not reveal any donor supported projects. This is, perhaps, due to the fact that project funds are managed directly from the Ministry of Finance.

The total annual expenditure for the Tanzania Forestry Research Institute amounted to Tshs 7.3 million in 1983/84 and Tshs 36.8 million in 1988/89. During the 1988/89 financial year, 41.3% of the annual recurrent budget was spent on research project activities; 40% on overhead costs and general management and support services. A significant portion of the Institute's budget was supported from external sources particularly by SAREC and Japanese financial assistance.

With regard to Tanzania Fisheries Research Institute, the annual total budget including capital expenditure for 1989 was Tshs 45 million. Out of this amount 23% was allocated to salaries and wages of non-scientific and other institution workers; 27.7% to overhead costs, general management and support services and salaries for

scientific and technical staff; 35.6% was for capital expenditures and the remaining 14.4% to research project activities. External source of funding accounted for 8.9% of the budget. The rest was government subvention. IDRC and the European Economic Community (EEC) funded part of the institute's research.

Zimbabwe:

Most of the research in Zimbabwe is funded by Government. Of the 10 organisations surveyed, only two received funding from private sources.

The research at the Zimbabwe Sugar Association Experiment Station is independently funded by the sugar industry of Zimbabwe. Its budget in 1988/89 was \$1,106,600. The Centre for Applied Social Sciences is funded by external and local sources. In 1989, the Centre received \$400,000 from external sources and local donations amounting to \$20,000. The government of the Republic of Zimbabwe provides grants to the Tobacco Research Board. In 1989, the grant amounted to approximately \$1.5 million. The Board has an additional source of funds through grower's levies, and income mainly through sales of tobacco and seeds, analysis charges, interest on investments, rents etc. The income raised through levies in 1989 amounted to \$2.6 million and that from other sources was \$780,000.

The Institute of Mining Research is funded through an annual grant from the Ministry of Mines and from contracts and donations. It is also supported by external donors including IDRC and SAREC. The total budget for 1988 was \$979,000.

The Forest Research Centre is Government funded but receives support from external sources including IDRC, Australian Council for International Agricultural Research (ACIAR) and the Ford Foundation. Its total budget for 1988/89 was \$1.9 million.

The research work at Matopos Research Station is wholly funded by Government. So is the National Railways of Zimbabwe. The latter receives some income from consultancies and services, an aspect which Matopos Research Station cannot apply by virtue of its structural mandate.

INSTITUTIONAL LINKAGES:

Kenya:

Locally, in Kenya, The Ministry of Research, Science and Technology and the National Council for Science and Technology maintain a forum which facilitates linkages

at both policy and operational levels. Informal linkages, however, have long existed between institutes of common interests, between individual scientists and between institutes and user groups. With exception of the Kenya Forestry Research Institute, established only in 1986, whose linkages are just emerging, the other research institutes have fairly well established local institutional linkages.

Kenya has four national public universities and several private universities with interest in R&D. There is active linkage between the institutions surveyed and these national universities through (a) involvement of university staff in special research projects funded by the research institutes, (b) training of postgraduates and their involvement in problem oriented research, (c) joint research activities involving university staff and institute research scientists, and (d) funding of basic and strategic research.

Strong linkages also exist with locally based international institutions both inside and outside Kenya. These linkages have proved useful in that the international institutions have availed expertise and fostered technology transfer processes, inspired local scientific staff through interactions and made available equipment and finances. These linkages have a strong training component at all levels; an advantage for strengthening local scientific and technical research capacity.

The survey revealed that linkages with foreign-based international institutions arise mainly out of donor initiative and are mainly with universities and institutions within the donor country of origin.

Participation in information dissemination, i.e. through seminars, conferences and workshops, through specialist groups and internal programme reviews, was brought out in the survey as very effective forum to consolidate linkages.

Linkage between institutes and user groups was registered as lacking in some ways and calling for serious consideration.

Malawi:

The National Research Council of Malawi is responsible for coordinating national efforts. It seems, for many years this role was not effectively carried out until about four years ago when the council status was elevated to a full government department. Intra-institutional linkages in the majority of the institutions is generally at programme level through some kind of multidisciplinary approach to the conduct of research and scientist to

scientist communication. There is reasonable linkage among the local institutions. It seems, however, linkages with outside organisations are stronger through technical assistance and project funds. This factor is more evident with the Geological Survey Department and Makoka Agricultural Research Station.

While a significant number of projects are funded by international development agencies, the private sector gave financial support to a couple of research project activities. Nu-Line Products Ltd. and Imperial Chemical Industries (ICI) currently support research on evaluation of chemicals for pest control. This is certainly a healthy development for Malawi.

Mozambique:

There are, at the moment, stronger linkages with non-national institutions than with other national institutions due to technical assistance, training activities and joint research and external funding. However, the need for inter-institutional linkages and collaboration within Mozambique is clearly recognised with the result that efforts are being made to coordinate research activities in the country in order to strengthen inter-institutional collaboration.

Tanzania:

The survey revealed, that in Tanzania, although particular institutions have different mandates, their operations are structurally and functionally linked even though they compete for both human and fiscal resources. The institutes are also linked with the policy-making institutions in that they play an important role in providing information essential for the preparation of the national development plans. Of particular significance is the linkage between the institutes and the ministries under which they operate and their linkage with the Planning Commission in the President's Office.

There exists strong linkages between the institutes surveyed and donor agencies and international development institutions. The National Institute for Medical Research, for instance, has collaborative linkages with WHO, IDRC, UNICEF, JICA, ICI, Rudolf-Geigy Foundation and the Swiss Medicus Mundi.

The Tanzania Industrial Research and Development Organisation has local-based inter-institutional linkages with its user/client constituency mainly for industrial application and use of the institute's results. The Tanzania Forestry Research Institute collaborates with the University of Dar es Salaam, local furniture and joinery industries and several non-national institutions

including SAREC and JOFCA. The Tanzania Fisheries Research Institute has collaborative linkages with Leiden University (Netherlands), IDRC, and ODNRI mainly for technical assistance and training.

Zimbabwe:

The survey revealed weak linkages among the local research institutions but significantly stronger linkages between local and outside organisations mainly through funding facilities and personnel exchanges. The linkages for Tobacco Research Board and Zimbabwe Sugar Association are mainly their clientele.

Matopos Research Station and the Forest Research Centre collaborate locally with the University of Zimbabwe, other research stations, government departments and user associations. Matopos Research Station has links with the European Economic Community. The Forest Research Centre collaborates with international organisations, donor agencies and with forest research institutes worldwide.

The National Railways of Zimbabwe's research is client oriented. It's collaborative linkages revolve around specific client needs.

The Institute of Mining Research and the Centre for Applied Social Sciences collaborate with a variety of government departments and related non-governmental organisations as well as international funding organisations usually on project basis.

National linkages with ICRISAT are in respect of all its research projects concerned with sorghum and millet. It also collaborates with Triangle Limited on investigation of the sweet stemmed sorghum.

CLIENTS FOR AND USERS OF RESEARCH OUTPUT:

Kenya:

The major client in Kenya for research output from the surveyed institutes is the government. However, the information generated from the institutes find their way to eventual users through a variety of means e.g. through extension services to farmers and through intermediate transfer agents such as suppliers of products to final customers.

The case is different with the two client-oriented research institutes namely: the Coffee Research Foundation and Tea Research Foundation. The research

products from these institutions are constantly sought and used by the coffee and tea industries respectively.

The Kenya Industrial Research and Development Institute is engaged in research and development activities of direct bearing to user needs. Its products are likely to be increasingly demanded by potential investors and its services are already playing a significant role in the private sector.

Results and recommendations from the R&D institutes are also widely used by the institutions of learning particularly the local universities in their teaching curricula and consultancy services.

Malawi:

As for Malawi, the output from the three agricultural research stations namely Chitedze, Makoka and Bvumbwe, is used largely by the extension service of the Ministry of Agriculture and government in the formulation of development plans and policies. Through the Ministry of Agriculture, smallholder and commercial farmers get access to the results. In the case of the Geological Survey Department, the government, potential investors and mining prospectors are the major clients. The demand for and use of research output from the Forest Research Institute of Malawi is largely government and parastatals. As agroforestry is being introduced to the smallholder sector, the demand for appropriate plants and trees from the Institute seems to be on the increase.

The products from Malawi Bureau of Standards are client-oriented. The demand for them is usually from industries and the government.

Mozambique:

In Mozambique, the government is the major client of the research output of the institutes surveyed. Much of the information is used for endogenous sectoral planning and development. With time, it is expected that the research results will permeate and have direct impact on wider user community. Some form of extension service set up exists in the country which is meant to facilitate technology transfer particularly from research institutions to users. The research output from the Archives of Cultural Heritage is perhaps useful in several ways including education, cultural conservation and the understanding of social factors that affect societal change.

Tanzania:

Survey results revealed that research output in Tanzania has not been readily taken up by the users except by government ministries which are the major clients of research results from the institutes. Donors, international development agencies and leading banks e.g. the African Development Bank and the East African Development Bank seem to be developing interest in the results of research institutes, perhaps, for use in project development and implementation. The industrial sector is a potentially active client of the Tanzania Industrial Research and Development Organisation. As for the National Institute for Medical Research, the Ministry of Health, the public national universities and policy decision makers are its major clients.

Zimbabwe:

Users of research output in Zimbabwe are varied but include mainly Government Ministries, District Councils, external donors and the private sector. The output from Matopos Research Station and the Centre for Applied Social Studies is used in extension and in the formulation of government plans and policy. The output from Matopos and similar institutions usually has poor outlet to the general public, planners and other technical institutions. The Institute of Mining Research is a valuable source of information to the mining industry.

The demand for results from the Zimbabwe Sugar Association by the sugar industry is significant but restricted to the large sugar estates and some private growers. Similarly, users of results from the Tobacco Research Board are basically the tobacco industry. The output from National Railway of Zimbabwe is used directly by the parastatal.

The research output of ICRISAT is demanded by national scientists and extension workers and development planners. It is also used by other institutions and scientists in the SADCC countries.

FACTORS FACILITATING OR LIMITING RESEARCH:**Kenya:**

Kenya is emerging into a new orbit of a technology dependent society because of its industrial development, quality of life and population development trend. What this means is that new emerging technologies must have impact on industrial development needs and uphold the medical and health requirements of the country's fast

growing population. Agriculture must turn to improved technologies to exploit the current 70% of the land area yet to be turned into use.

The options are limited to emphasising and encouraging technology development as the base for Kenya's future national development.

In Kenya, there appears to be the political will and commitment to promote science and technology as evidenced by the existing institutional arrangements as well as policies on research and development.

Malawi:

The National Research Council of Malawi, a body responsible for the country's science and technology policy, experienced stagnancy for some time. It has, however, been reinvigorated. There is need to reappraise and refocus its role and future in order to strengthen its contribution to national planning and development.

There is a further need to rationalise research under the National Research Council on industry, geology, health sciences and social research. This action will ensure consistent research quality and development.

Research Management is considered pivotal to effective and efficient conduct of research in national research institutions. Investment in research in Africa is profitable only when researchers are capable of designing good research projects, monitoring their implementation and packaging the ultimate results in a manner that will facilitate their utilisation.

Promotion of linkages among institutions sharing common interest is an essential element worth of serious consideration. In this respect, an inventory of national, regional and international organisations, their facilities and activities in Sub-saharan Africa is strongly encouraged. It will facilitate networking and end any costly overlaps.

Mozambique:

The human base in Mozambique though quite central to the success of the country's research is undoubtedly very weak. The University's 1989 intake of 800 undergraduate students in all fields is extremely low. Moreover, the poor research funding and dependency on external sources for R&D funds are issues that demand immediate attention. In this regard, there is need to maintain strong linkages with non-national institutions and the donor community on one hand, and on the other hand, for the international

development agencies and donors to assist Mozambique to emerge from its present R&D operational orbit.

Tanzania:

Resources allocated in the research institutes surveyed are insufficient. The scientific manpower is inadequate generally in all research institutions in Tanzania. This means, therefore, that institutions and specific research areas are understaffed. There exists also a general imbalance between scientists and technical support capacity.

Survey responses showed clearly that financial allocation are inadequate and in some cases declining. Although some institutions are thriving on external sources of funding for their research activities, the sustainability of such financial flow is questionable.

Otherwise, the policies and institutional arrangements in place are adequate and well established to facilitate the development of science and technology research and development in Tanzania.

Zimbabwe:

In the case of Zimbabwe, the government has the will and is committed to providing financial support to research institutions. The major problem facing the national institutions is a lack of skilled technical and professional manpower. The University of Zimbabwe is, at the moment, unable to turn out such categories of human resource in sufficient numbers. The University does not offer courses in specialised fields needed in the research and development areas. Consequently, there is much dependence on out-of-country training for master's and doctoral degrees.

There is a significant exodus of scientific staff from research institutions to the private sector primarily because of the lucrative salaries and better conditions of service offered by the latter.

Research budgets of the research institutions surveyed generally point to inadequacy of funds for effective research undertaking. This is exemplified by lack of research equipment, limited availability of journals and loss of experienced personnel. The turnover of professional and technical staff is a reflection, to a certain extent, of the government policy concerning salary levels. The government should encourage greater involvement of the private sector in research or to funding some of the research. It should also consider providing financial incentives to research workers.

III. CONCLUSION

DEPTH AND QUALITY OF INFORMATION:

The present survey covered 33 institutions in 5 countries. The institutions surveyed have diverse mandates, functions and operational policies. Some have a long history while others have been established within the past ten years. The majority of the institutions are in the agricultural and natural resources sector. These institutions appear to have longer operational histories than the others but the quality and extent of information available in these institutions was better than in the others and more readily retrieved.

It was evident from the survey responses, that there is a lot of information available on almost all the aspects investigated, but it is poorly stored. Information appears to be scattered in old files, on small scraps of papers held in different offices and ministries or even in government archives. Such information is not easily accessible. This observation exposes the need to upgrade periodically the capacity of national research institutions for information management.

The depth and quality of information was affected by the short duration within which the survey was undertaken. It would have been useful if the survey was conducted over a period of 4-6 months.

The survey revealed that some research institutions have little access to basic information concerning levels of resources allocated to their institutions and have little influence on resource allocation. This was exemplified by the response from Mozambique where block allocations are distributed and controlled from the Ministries responsible for specific institutions. In this regard, Ministries are the appropriate source of information on research resources rather than the research institutes themselves. It would be essential to penetrate the Ministries' accounting and establishment units in order to obtain better quality information. In future studies this will be necessary for improvement in the quality and depth of information, and to facilitate relevant national research institutions to interact more closely with bookkeepers, accountants and officers in as far as resource management is concerned.

Whereas comprehensive numbers were provided on human resources, the information did not give any indication of whether the current or any given research staff position is adequate or inadequate. In some sectors it was evident that appropriate staff was inadequate and sometimes totally lacking.

It appears from the national research resource survey reports that budget figures and line allocations and expenditure accounts could not tally. Expenditure figures were more than those of the overall budget. The source of this disparity seems to be in overlapping accountability or double entry charges. This is another case of the poor quality of information.

RECOMMENDATIONS:

This survey while quite revealing is not thorough. It was conducted at short notice over a very short period and covered only five out of 13 countries in the Eastern and Southern Africa FAMESA network. Two obvious recommendations are: (1) that a similar but indepth study be extended to other countries in the region and, if possible, to each R&D institution including the small stations. This might sound a laborious and costly proposal but is a worthwhile consideration; and (2) that the results of the survey are of interest to other countries and institutions in Sub-saharan Africa. A regional workshop on research resource investment in national research institutions would be beneficial where the report of the survey would be presented and the results as well as related policy implications can be thoroughly examined.

The spectrum of users of research output is quite narrow. The reason is partly historical; also the national economies may not be sufficiently developed to create the demand for the research results. In this regard a study could be considered to examine the constraints on the demand for and the potential for expanded use of research output.

The level of recurrent expenditure on personnel emoluments, general management and support activities in the majority of institutions surveyed is colossal. The allocation left for actual research is generally insufficient. Research institutions and national policy custodians should be advised and encouraged to increasingly turn to appropriate modes of funding research. Project-based funding by external sources to national research institutions and national-based NGOs coupled with flexible core programme funding, might be considered.

There is an indication that budget development, accounting and internal control are responsibilities left to accountants and financial controllers. These elements are critical in institutional and programme management. Emphasis should be given to developing awareness on financial and management skills in national research institutions among scientists. The solution might be the promotion of financial management education and training programmes on the poorly understood aspects including reporting systems and internal control.

With regard to institutional linkages, current initiatives are taken mainly by donors and international development agencies. This is partly due to the lack of information support systems

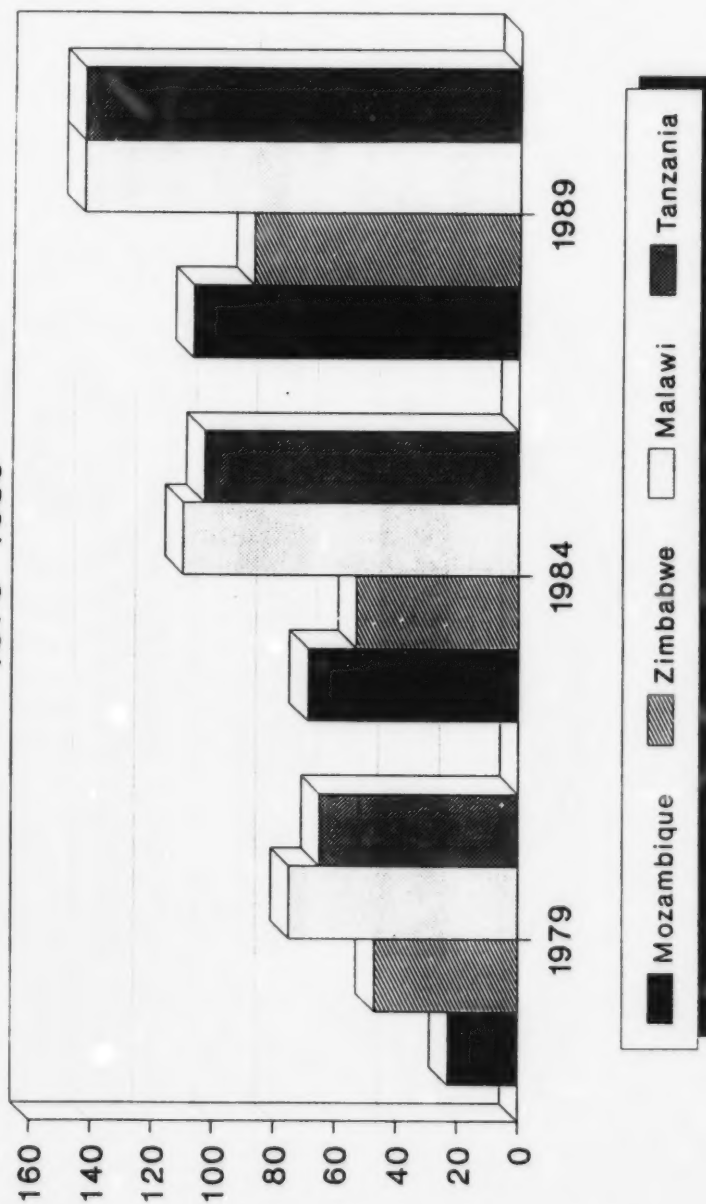
in national research institutions. It is recommended that some information support in this area be developed to assist managers of national research institutions to become more conversant with and active in initiating internal and external institutional linkages.

The effort in human resource development in all the countries and institutions surveyed is commendable. Further focus should be on non-traditional and emerging areas of specialisation. Donor support in this respect should take cognizance of the different needs and emphases of different institutions. The need to promote proper and maximum human resource utilisation in national R&D, mainly through incentive, proper placement and project support, is perceived as an absolute necessity.

Finally, it seems appropriate, at this stage to observe, that resource availability and resource utilisation are not in themselves sufficient. Rather, it is how effective the available resources are utilised that seems critical. Various national and international institutions are involved in supporting research in one form or another. There is real need to develop national capacities to integrate and coordinate such support and focus it to institution-building.

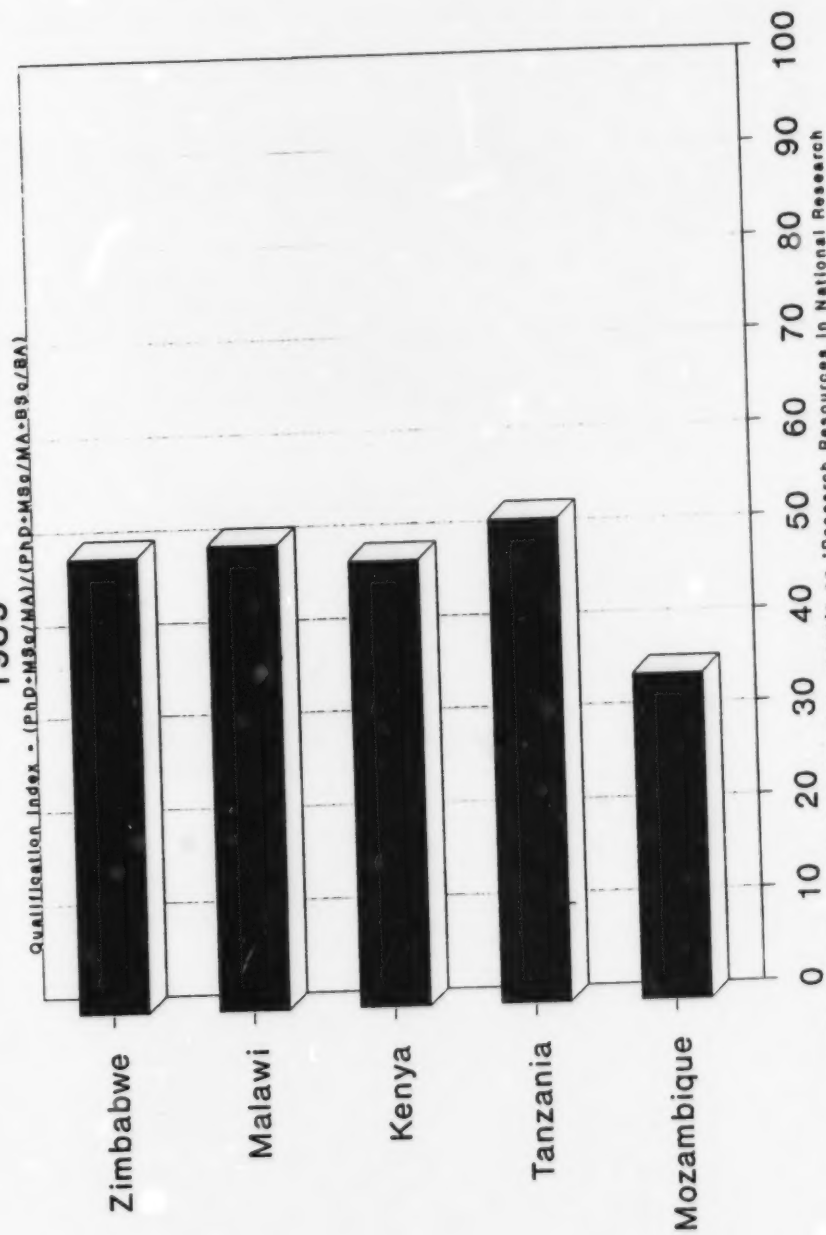
It is recommended, therefore, that IDRC should consider, within its present strategy of institution building and financial resource limitations, to create a resource management promotion unit in each region to promote integrated and coordinated support for research institutions and institution building, strengthen the management of inter-country cooperation in R&D, and promote interface between research and financing institutions and users of research output.

TREND IN TOTAL NUMBER OF SCIENTISTS **For Selected National Research Institutions** **In Eastern and Southern Africa** **1979-1989**



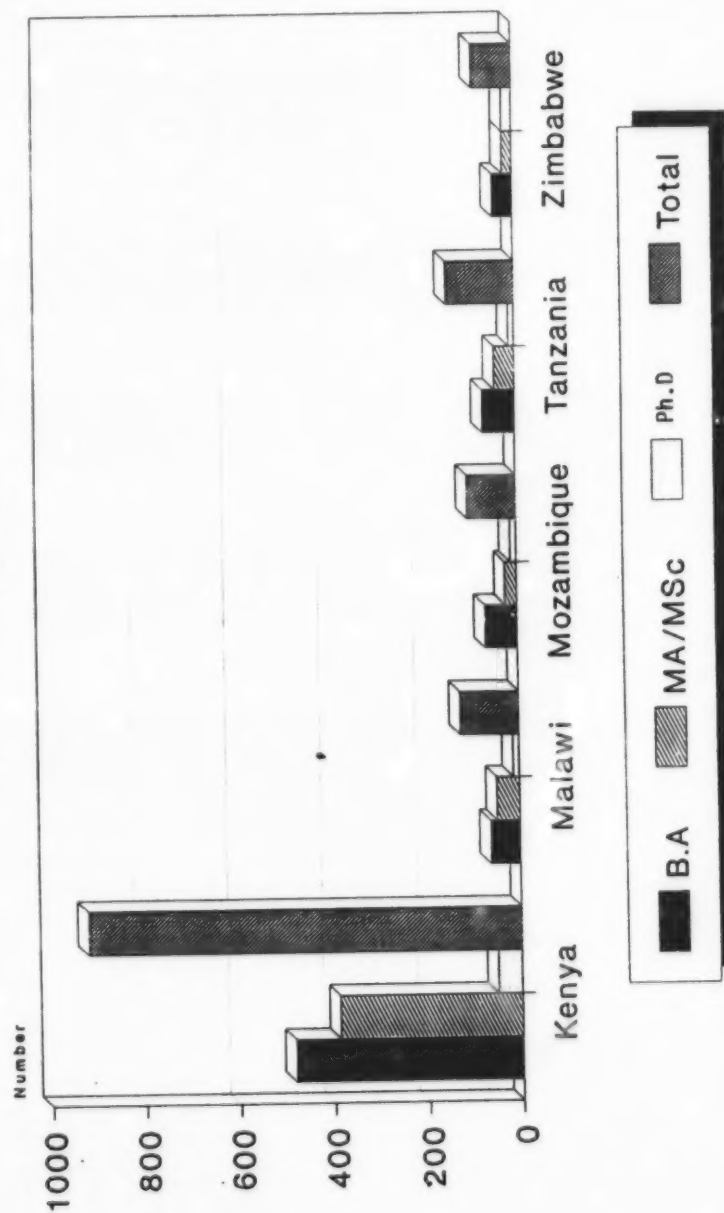
Source: Authors calculations based on data from country reports on "Research Resources in National Research Institutions in Eastern & Southern Africa", OPE, IDRC, 1989.
 -Comparative data not available for Kenya.
 -1976 data used for Mozambique in 1979.

Scientific Staff Qualification Index For Selected National Research Institutions in Eastern and Southern Africa 1989



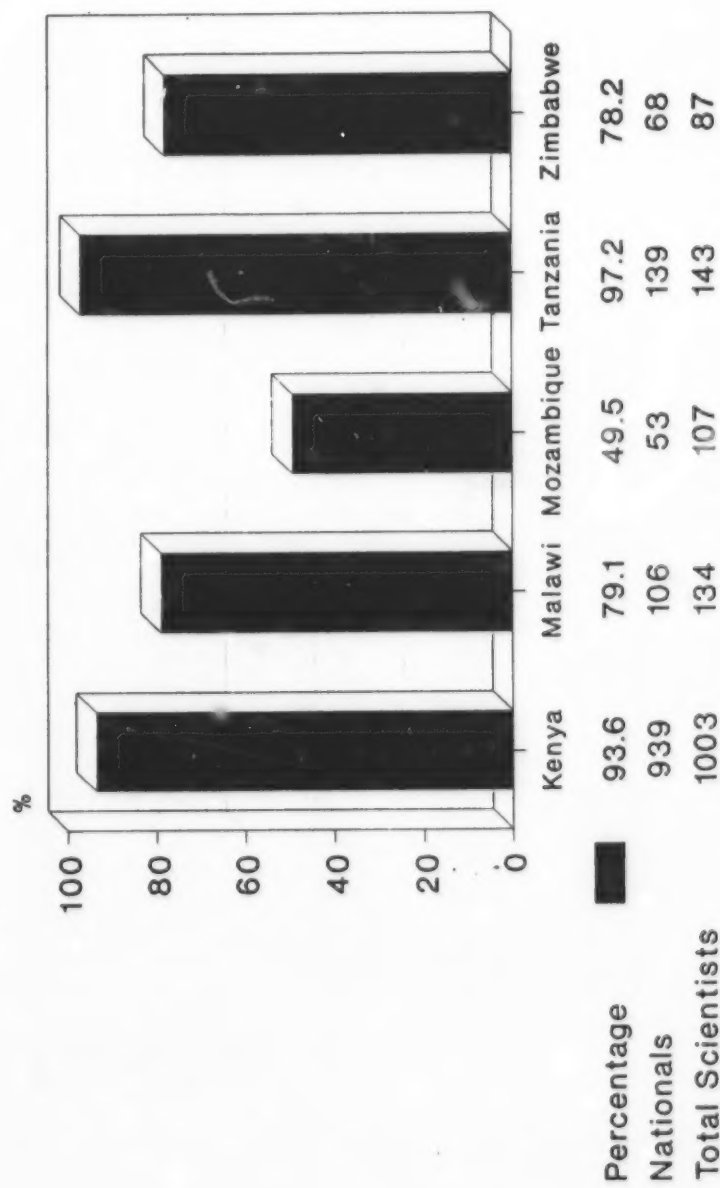
Source: Authors calculations based on data from country reports on "Research Resources in National Research Institutions in Eastern and Southern Africa", OPE, IDRC, 1989.

Number of Scientists with at least a Second Degree For Selected National Research Institutions in Eastern and Southern Africa 1989



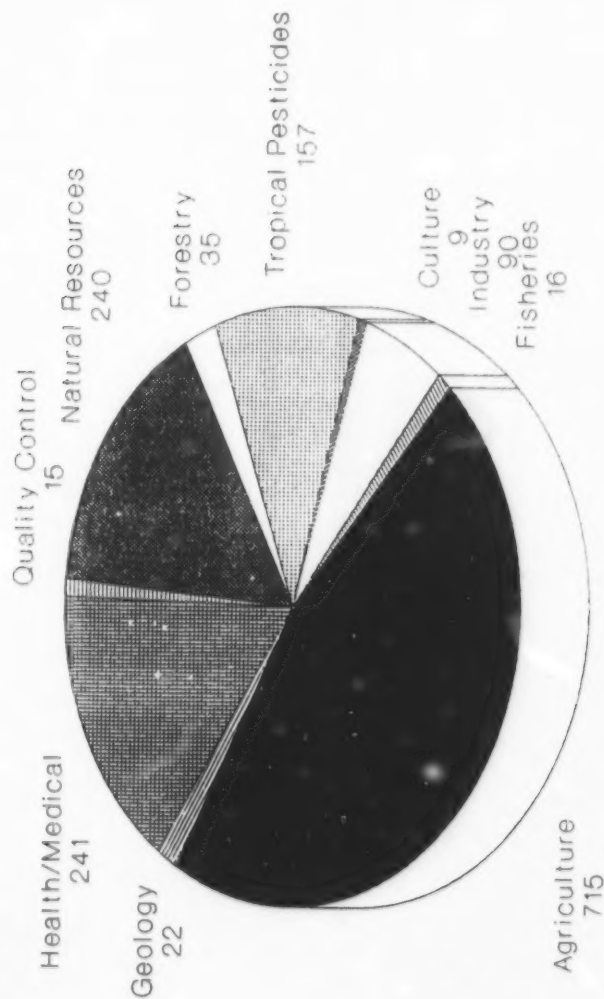
Source: Authors calculations based on data from country reports on "Research Resources in National Research Institutions in Eastern and Southern Africa", O.P.E.I.D.R.C. 1989.

MAJORITY OF SCIENTISTS ARE NATIONALS
For Selected National Research Institutions
In Eastern and Southern Africa
1989



Source: Authors calculations based on data from country reports on "Research Resources in National Research Institutions in Eastern and Southern Africa", OPE/DRC, 1989.

SCIENTIFIC STAFF BY RESEARCH SECTOR For Selected National Research Institutions in Eastern and Southern Africa 1989



Source: Authors calculations based on data from country reports on "Research Resources in National Research Institutions in Eastern & Southern Africa", OPE, IDRC, 1989.
-Based on data from Kenya, Mozambique, Malawi and Tanzania.
-Data not available for Zimbabwe.

ANNEX VI

SOURCE OF RESEARCH FUNDING
FOR SELECTED NATIONAL RESEARCH INSTITUTIONS
IN EASTERN AND SOUTHERN AFRICA¹

COUNTRY	GOVERNMENT SUBVENTION	EXTERNAL FUNDING ²	RATIO GOVT: EXTERNAL
Tanzania (T. Shs)	169,330,086	11,258,000	15:1
Mozambique (Meticals)	645,684,000	1,041,085,251	1:1.6
Kenya (K Shs) ³	26,147,401	10,390,748	2.5:1

Source: Authors calculations based on data from country reports on "Research Resources in National Research Institutions in Eastern and Southern Africa", OPE, IDRC, 1989

¹ Data not available for Malawi and Zimbabwe

² Figures include funds from international donor agencies. Funds for consultancies and private donations are not included

³ Figures for 1988/89

BUDGET ALLOCATION ON PERSONNEL
EMOLUMENTS AND
RESEARCH EXPENDITURE FOR
SELECTED NATIONAL RESEARCH INSTITUTIONS
IN EASTERN AND SOUTHERN AFRICA
1989

COUNTRY	RECURRENT BUDGET	PERSONNEL EMOLUMENTS	RESEARCH PROJ. COST	PERSONNEL/ RECURRENT (%)	PERSONNEL/ PROJ. COST (%)
Tanzania (T. Shs)	174,626,948	56,396,567	38,765,838	32	145.5
Malawi (MK)	7,016,837	2,407,929	1,369,047	34	176
Mozambique (Meticaais)	592,032	345,187	—*	58	—*
Kenya (K Shs)	30,162,004	20,386,589	—*	67.6	—*

* Data not available

ANNEX VIII

CONSULTANTS' BIOSKETCHES

F.M. BANDA:

Is Malawi's national FAMESA coordinator and Principal, Malawi Institute of Management. For ten years he was Director and chief executive officer of Malawi Bureau of Standards after serving the same institution as its Deputy Director for three years. He held several responsibilities, as lecturer and senior tutor at Chancellor College, University of Malawi, and trainer in the Department of Community Services, Government of Malawi, after serving in the management of Agricultural Development and Marketing Board.

Dr. Banda has served as management consultant in the FAMESA special project since 1983 and Chairman of many national bodies and regional activities such as expert groups on management of science, industry and technology, research management and administration, packaging of appropriate technology, quality standardisation etc. In 1981 he attended the Chief Executive Programme at the International Management Institute in Ireland.

H.F. BITANYI:

Holds the position of Director of Research Coordination and Promotion in the Tanzania Commission for Science and Technology, UTAFITI. Dr. Bitanyi obtained his doctorate in genetic engineering. He was leader of the biotechnology research charged with management of research scientists and a large group of support staff. He held several management positions in the national research system before moving to UTAFITI. Since the inception of FAMESA, Dr. Bitanyi has been involved, as consultant and resource person, in the assessment of research management training needs and evaluation of research management training impact in the FAMESA region in addition to the role he played in the development and validation of research management training material.

C.M.R. DINIZ:

Is Director of Studies and International Projects at the Eduardo Mondlane University and national FAMESA coordinator for

Mozambique. Her management experience is founded on her graduate background in economics and accountancy. She worked as Programmer and trainer with National Cash Register (NRC) and Mozambican Railway Company prior to being appointed Director of Finance and Administration and her present position at the University.

Ms. Diniz has served as consultant and resource person on various FAMESA assignments including the development of the manual for training of R&D administrators on Strategic Project Planning and Budgeting and its translation in portuguese and the evaluation of the R&D manual on Institute-Constituency Relations.

Z.M. NYIIRA:

Prior to his present responsibilities of Coordinator of the special project on Financial and Administrative Management of Research Projects in Eastern and Southern Africa (FAMESA), Dr. Nyiira was Head, Institutional Building and Interactive Research Unit at the International Centre of Insect Physiology and Ecology (ICIPE) where he also held various assignments including Head, Outreach and Training Programmes, Station Manager, ICIPE's Mbita Point Field Station, and Project Leader of the International Fund for Agricultural Development (IFAD) funded project on Cassava Green Spider Mite. Before joining ICIPE, Dr. Nyiira, a Pearson Fellow, served as Senior Research Fellow with the International Service for National Agricultural Research (ISNAR); Director, International Cooperative Programme, and NGO funded activity; Chief Agricultural Research Officer; and Director of Research Ministry of Agriculture, Uganda, in addition to his professional positions of Senior Principal Research Scientist at the ICIPE and several such positions in Uganda's national agricultural research system. Dr. Nyiira is also Chairman of The Society of Pest Management for Africa and Editor of African Association of Insect Scientists.

J.K. OMUSE:

Spent many years as a practicing veterinary research scientist in various professional positions before being appointed to a management position with the National Council for Science and Technology (NCST) in Kenya's Ministry of Research, Science and Technology. He is currently Deputy Director of Kenya Trypanosomiasis Research Institute (KETRI). His service in the NCST, the Ministry and KETRI brought him to grips with national resource allocation policies and overall

research management problems; the experience he has constantly shared through FAMESA since its inception. He is one of the regional FAMESA resource persons in the subject of institutional linkages.

B. RAPTOPOULOS:

Has extensive experience in management and management-related issues, having been involved in development studies and evaluation of the impact on development of institutional performance. He currently holds the position of Deputy Director of the Zimbabwe Institute of Development Studies.

ACKNOWLEDGEMENTS

Key actors, who were very inspiring and extremely supportive in this project were Mr. John Hardie, Deputy Director, and Mr. Andrew Asibey, Planning Officer, both of the Office of Planning and Evaluation (OPE), International Development Research Centre (IDRC), Ottawa, Canada. To them I owe a great debt. It would be presumptuous to claim an accomplishment of this magnitude without acknowledging the functional and moral support of Drs. F.M. Banda (Malawi), H.F. Bitanyi (Tanzania), C. Diniz (Mozambique), J.K. Omuse (Kenya) and B. Raftopoulos (Zimbabwe). To them I express my gratitude. Dr. A. Bekoe, Regional Director, and Dr. Issa Omari, Senior Programme Officer, at the IDRC, Nairobi, Kenya were extremely helpful. I was very much assisted by my wife, Juliet M. Katusiime-Nyiira, in the process of undertaking this project to the extent of deserving her inclusion in this acknowledgement. To all these people, I say thank you.